7-1943

Bulletin No. 309 - An Economic Analysis of the Milking Enterprise on Farms in the Ogden Area, Utah, 1937-39

George T. Blanch

Dee A. Broadbent

AN ECONOMIC ANALYSIS OF THE MILKING ENTERPRISE ON FARMS IN THE OGDEN AREA, UTAH, 1937-39

By
GEORGE T. BLANCH
DEE A. BROADBENT

BULLETIN 309

AGRICULTURAL EXPERIMENT STATION
UTAH STATE AGRICULTURAL COLLEGE
LOGAN, UTAH

AN ECONOMIC ANALYSIS OF THE MILKING ENTERPRISE ON FARMS IN THE OGDEN AREA, UTAH, 1937-39

By

GEORGE T. BLANCH

DEE A. BROADBENT

Department of Agricultural Economics

BULLETIN 309

AGRICULTURAL EXPERIMENT STATION

UTAH STATE AGRICULTURAL COLLEGE

LOGAN, UTAH

July, 1943

Acknowledgments

The authors wish to thank the farmers and the dairy products companies who furnished information for this study; Dr. W. P. Thomas, head of the Department of Agricultural Economics, Utah Agricultural Experiment Station, for helpful assistance and criticisms; and the several student assistants and others who helped in gathering the data or with the tabulations.

Foreword

This report is part of a study begun in 1937 in the area from which milk is marketed in Ogden. This area includes Weber and Morgan Counties and that portion of Box Elder County south of Honeyville and west to Corinne and east to the mountains. Included in this study are three phases, namely: (1) A farm management study of farms with dairy enterprises in the Ogden Area; (2) An economic analysis of the milking enterprise on the same farms; and (3) A business analysis of the Weber Central Dairy Association. The general purpose of this study was to add to the limited information concerning the economic factors that affect production and marketing of dairy and other farm products in the general irrigated type of farming area of nothern and central Utah.

The specific objectives of this study were: (1) To ascertain and emphasize the factors affecting the incomes from farming; (2) To ascertain the place that dairy cows should occupy in the organization of farms in this area; (3) To study the factors affecting the costs and returns from the milking enterprise; and (4) To ascertain the factors affecting the marketing of dairy products and the relationship of marketing to production. The first two of these objectives were treated in bulletin 308, *A farm management study of farms with dairy enterprises in the Ogden area, Utah, 1937-39.* The fourth objective is reported in bulletin 301, *A business analysis of the Weber Central Dairy Association.* The third objective is treated in this report.

The data for 1937 and 1938 were obtained by the survey method, and for 1939 by a combination of the survey method and account books. For all three years the data on milk sales were obtained either from the records of the purchasing company or from complete statements of sales kept by the farmers.

Contents

AN ECONOMIC ANALYSIS OF THE MILKING ENTERPRISE ON FARMS IN THE OGDEN AREA, UTAH, 1937-39[1]

GEORGE T. BLANCH
DEE A. BROADBENT[2]

INTRODUCTION

THE area included in this study is part of the better irrigated section of Utah. Although the soils are variable, that part used for arable agriculture is generally fair to good. The poorer soils are used largely for pastures which makes necessary a forage-consuming livestock enterprise in the farm organization. Dairy cattle is the type of livestock most common. Topography, climate, irrigation water supply, transportation, and markets all permit or favor a relatively intensive and successful cash-crop and dairy type of farming. The average farm is relatively small in area of cultivated land which also makes necessary intensive usage, high rates of production, and efficient organization and management if the business is to prosper financially.

The primary purpose of this report is to present an analysis of data pertaining to the milking enterprise. An attempt is made to point out the factors and relationship most important in affecting the costs and returns, or the financial success, of the milking enterprise. As this is the most important single enterprise on these farms, it is desirable that it be operated with the greatest efficiency possible.

DESCRIPTION OF THE MILKING ENTERPRISE

THE milking enterprise, as the term is used in this report, includes all cows kept for the production of milk whether dry or in milk. It does not include calves, bulls nor heifers. A heifer was considered as joining the milking enterprise at the time of freshening. Also included in the inventory of the enterprise were values for the proportion of the farm buildings, equipment, corrals and lanes used in caring for the milking cows and the milk. Buildings used for the storage of feed, and pastures were not included in the enterprise inventory.

---

[1]Contribution of the Department of Agricultural Economics, Utah Agricultural Experiment Station. Report on project 149-Purnell.

[2]Research associate professor and research assistant professor, respectively.

NUMBER OF COWS PER FARM

A total of 452 records were used in this study (table 1). For the three years of the study, the average number of cows kept per farm in the milking herd was 10.2. The farms in the high valleys kept

Table 1. *Number of farms and cows per farm by areas, for each year*

Area	Number of farms				Number of cows per farm			
				Average				Average
	1937	1938	1939	1937-39	1937	1938	1939	1937-39
High Valleys*	40	39	28	36	12.2	12.1	12.6	12.3
Northern Weber†	51	47	40	46	11.1	10.9	11.3	11.1
Western Weber‡	44	44	39	42	8.2	7.9	8.1	8.1
Box Elder§	16	33	31	27	7.5	9.5	9.3	8.8
Total	151	163	138	151	10.2	10.1	10.2	10.2

*Includes Morgan County and Ogden Valley in Weber County.

†Includes the communities of Marriott, Slaterville, Farr West, Harrisville, North Ogden, and Pleasant View, all in Weber County.

‡Includes the communities of Plain City, Warren, West Warren, West Weber, Taylor, Kanesville, and Hooper in Weber County and four farms in Davis County.

§Includes all farms in Box Elder County.

the most cows, with an average of 12.3, while the fewest cows, 8.1 per farm, were kept in the western Weber area. In no area was there any material change in the number of cows kept during the 3 years. In Box Elder County, there was an increase from 7.5 cows to 9.5 between 1937 and 1938. This, however, was the result of an enlarged sample of farms, rather than a change in the number of cows on the same farms.

Most of the cows included in this study were grades. Usually, however, the characteristics of one particular breed stood out above the others. The most common breed was Holstein, but both the Jersey and Guernsey breeds were well represented. Also some beef breeds, particularly Shorthorn, were milked to a limited extent. In most cases, these had been crossed with one of the dairy breeds. On a few farms, all of the cows were purebreds. Because of the difficulty of classifying many herds on the basis of a single breed, no attempt has been made to relate breed to other factors. The general trend in the area is toward improving the production of the cows by the use of purebred dairy sires.

In 1938, 16 percent of the farms had an average of less than 6 cows, while 15 percent had 15 or more. The balance, or 69 percent, had from 6 to 15 cows. One half of the farms with less than 6 cows were in the western Weber area, while 12 of the 25

farms, with 15 or more cows, were in the high valley area. Farms keeping less than an average of 5 cows were not included in the study unless they sold an average of more than 1,000 pounds of butterfat during the year.

INVESTMENT

The average investment per farm in the milking enterprise for the 3 years was $1,079, of which 58 percent was in cows and 34 percent in buildings (table 2). The variation was from $1,040 per

Table 2. *Investment in the milking enterprise, 1937-1939*

Investment in	Average amount per farm 1937-1939	Average amount per cow 1937-1939
	dollars	*dollars*
Cows	630	62
Buildings	362	36
Corrals and lanes	46	4
Equipment	39	4
Other	2	*
Total	1,079	106

*Less than one-half dollar

farm in 1939 to $1,110 in 1938. The larger part of this variation was in buildings. The investment in equipment was only $39 per farm. This consisted largely of milk cans and pails. A few farms had milking machines, while a few more had cream separators. A number of farmers reported the ownership of cream separators that had not been used for several years. In such cases, the separators were not included in the value of equipment.

The 3-year average total investment per cow amounted to $106. The total investment per cow and per farm was low when compared with some of the more intensive dairy areas of the United States.

The variation in total investment per cow was greater between areas for the same year than it was between years. In 1938, the variation between areas was from $131 per cow in the high valleys to $97 in the Box Elder area (table 3). The greater part of this difference was in the investment in buildings, though the high valley farmers also valued their cows higher than the farmers in the other areas. The difference in the investment in buildings was noticeable, but there was no apparent reason why the lowest valuation for cows was in northern Weber County, where the butterfat production per cow was highest.

Table 3. *Comparison of number of cows per farm and average investment per cow in different areas, 1938*

Area	Average number of cows per farm	Average investment per cow in:		
		Buildings	Cows	Total*
		dollars	*dollars*	*dollars*
High valleys	12.1	55	67	131
Northern Weber	10.9	39	56	103
Western Weber	7.9	30	63	101
Box Elder	9.5	24	66	97
All farms	10.1	39	63	110

*Includes investment in buildings, equipment, corrals, lanes and stock.

Considerable variation existed in the total investment per cow. In 1938, on 15 percent of the farms, the average investment per cow in the milking enterprise was less than $75, while on 12 percent it was $150 or more. The majority of farmers, 59 percent, had from $75 to $125 invested per cow.

BUTTERFAT PRODUCTION

The average amount of butterfat produced per farm per year was 2,568 pounds (table 4). It increased from 2,458 pounds in 1937 to 2,554 pounds in 1938 and to 2,692 pounds in 1939, an increase

Table 4. *Butterfat produced per farm and per cow by areas, 1937, 1938 and 1939*

Area	Pounds produced per farm				Pounds produced per cow			
	1937	1938	1939	Average 1937-39	1937	1938	1939	Average 1937-39
High valleys	2,932	3,055	3,412	3,133	241	252	272	255
Northern Weber	2,794	2,830	3,050	2,891	251	259	269	260
Western Weber	1,918	2,020	2,114	2,017	233	256	260	250
Box Elder	1,685	2,220	2,307	2,071	224	239	247	237
Average—all farms	2,458	2,554	2,692	2,568	242	253	263	253

between 1937 and 1939 of 234 pounds. Inasmuch as the average number of cows per farm remained essentially the same, the increase resulted from increased production per cow.

The average production per cow was 242 pounds in 1937, 253 pounds in 1938 and 263 pounds in 1939, or an increase of 21 pounds of butterfat. The increase was greatest in the high valley area and least in the northern Weber area, where the 3-year average production was highest. The lowest production per cow was in Box Elder County.

The rather large increase in production per cow is probably the result of several factors, including better dairy stock replacing that culled out, better culling made possible by larger membership in cow-testing associations, and better feeding. The change in feeding will be shown later.

For the three-year period, 14.4 percent of the herds studied produced less than 200 pounds of butterfat per cow, while 10.6 percent produced 320 pounds or more. Breed of cows, quality of cows, feeding, housing and other management practices are probably all important in affecting the production of individual cows. Within many herds of low average production, there probably were some high producing individual cows. But it is the herd average that is important in determining the profits from the enterprise. As will be shown later, butterfat production per cow had an important effect upon profits.

METHOD OF DISPOSAL OF DAIRY PRODUCTS

During the three-year period, 42 percent of the butterfat produced was sold at wholesale as market milk, while 39 percent was sold for processing (table 5).[3] Most of the process milk was used for

Table 5. *Method of disposal of dairy products in different areas, 1937-1939*

Method of disposal	Percent of total				
	High Valleys	Northern Weber	Western Weber	Box Elder	All farms
Market milk sold wholesale	60.2	70.4	3.7	.....	42.2
Market milk sold retail	.1	.4	.6	.9	.4
Process milk sold wholesale	21.0	16.3	74.2	74.4	39.1
Process cream sold wholesale	4.0	.9	3.7	6.9	3.3
Used in home	6.6	4.5	7.3	7.3	6.2
Fed to calves	8.1	7.5	10.5	10.5	8.8

butter. A smaller portion was used for ice cream and a very small amount was condensed. Some of the milk classified as market milk and paid for on that basis was processed particularly into ice cream, but how much is not known. The outlet for the dairy product as market milk was almost entirely confined to the high valleys and the northern Weber area, where 60 and 70 percent, respectively, of the total production was sold for this purpose. The reason for the concentration of market milk in these two areas is probably to be found in the fact that the farmers here have been

[3]However, more than half of the producers sold on the processing market.

engaged in commercial dairying for a longer period of time than have farmers in the other two areas. In western Weber County and Box Elder County, approximately 75 percent of the product was sold for processing purposes and practically none for market milk.

Dairy products were sold to about four types of business organizations. A farmers' cooperative, engaged primarily in making butter, but also distributing some whole milk, obtained considerably more than any other single company. Another outlet was to private companies engaged primarily in the distribution of whole milk, but who also processed. A third outlet was to smaller companies who engaged entirely, or almost entirely, in retail distribution. Finally, a small amount went to companies engaged only in processing, either butter or condensed milk. The local market for dairy products was characterized by keen competition between the several companies handling the product.

The average price received for butterfat was quite different for the different methods of sale. Milk sold at retail brought the highest price, an average of 53.5 cents per pound butterfat during the 3 years (table 6). No producer, however, sold any consider-

Table 6. *Prices received per pound for butterfat marketed by different methods each year, 1937-1939**

Method of marketing	1937	1938	1939	Average 1937-39
		cents		
Market milk sold wholesale	46.9	41.4	39.6	42.6
Market milk sold retail†	53.7	53.8	53.0	53.5
Process milk sold wholesale	41.8	32.2	33.0	35.7
Process cream sold wholesale	38.8	29.1	29.0	32.3
Average—all farms	44.4	36.7	36.2	39.1

*These prices are for the product delivered at the buyer's plant. The farm price woud be these prices minus the costs of hauling, which averaged 3.15 cents per pound for all butterfat sold.

†This was all sold on the basis of so much per quart or per gallon. Conversion to the butterfat base was made on the basis of the average butterfat content of the milk sold from the same farms at wholesale.

able proportion of his product by this method. The butterfat sold as market milk brought an average of 42.6 cents per pound as compared to an average of 35.7 cents for that sold in whole milk for processing and 32.3 cents per pound for that sold as cream for processing. The average spread between the prices received for market milk and process milk was 6.9 cents per pound butterfat and between market milk and cream 10.3 cents per pound.

The spread between market milk and process milk was 5.1, 9.2 and 6.6 cents per pound for 1937, 1938 and 1939, respectively. The differences in the prices received were greater by far than the difference in the costs of production.

The average price received for butterfat sold declined 8.2 cents between 1937 and 1939. The greatest decline was in the lower priced products as cream declined 9.8 cents, process milk 8.8 cents, and market milk 7.3 cents per pound butterfat.

RECEIPTS FROM THE MILKING ENTERPRISE

The total value per farm of all products attributable to the milking herd was $1,091 per year (table 7). It varied from $1,182 in 1937 to $1,021 in 1938. The decline in the price of butterfat between

Table 7. *Total receipts and credits to milking herd, 1937, 1938 and 1939*

Item	Average value per farm				Percent 1937-39
	1937	1938	1939	1937-39	
			dollars		
Butterfat sold	917	804	835	852	78
Butterfat used in home*	60	46	52	53	5
Butterfat fed to calves*	92	65	72	76	7
Skim-milk produced on farm†	5	5	6	5	—
Credit for calves‡	26	20	23	23	2
Credit for manure§	82	81	82	82	8
Total	1,182	1,021	1,070	1,091	100

*Calculated at the average farm value of butterfat sold.

†Calculated at 2½ cents per gallon.

‡Calculated at $2.50 for each live calf born and kept or sold. No credit was given for calves killed at birth.

§Calculated at $8 per cow.

1937 and 1938 more than made up for the increased production. Of the total values, 78 percent was for butterfat sold, 8 percent was credit for manure and smaller proportions for milk fed to calves, used in the home, and for calves and skim milk.

TOTAL EXPENSES OF THE MILKING ENTERPRISE AND COST OF PRODUCING BUTTERFAT

The total, or gross, expenses per farm were nearly the same for each of the three years, being $1,212 in 1937, $1,191 in 1938, and $1,196 in 1939, or an average of $1,200 (table 8). These expenses included the cost of producing calves, skim milk, and also manure, in addition to the butterfat sold or used at home. The credit for, or value of, these items was $110 which leaves the cost of

butterfat $1,090. Together, feed and labor made up 86 percent of the cost of producing butterfat. Hauling milk, interest on the investment, depreciation on cows and buildings were some of the other more important items of expense.

Table 8. *Expenses of the milking enterprise and cost of butterfat, 1937-1939*

Item of expense	Average amount			Percent net cost of butterfat
	Per farm	Per cow	Per pound butterfat	
	dollars	*dollars*	*cents*	*percent*
Harvested feed	380	37.39	14.80	34.9
Farm pasture*	105	10.36	4.10	9.6
Farm fields*	39	3.85	1.52	3.6
Total feed	524	51.58	20.42	48.1
Man labor at 25c per hour	413	40.61	16.07	37.9
Hauling milk	81	7.95	3.15	7.4
Horse, truck and auto use	11	1.12	.44	1.0
Interest on investment at 5 percent	54	5.31	2.10	5.0
Net depreciation on cows	32	3.11	1.23	2.9
Depreciation and repairs on buildings and equipment	23	2.30	.91	2.1
Bedding	15	1.40	.58	1.4
Bull service	20	2.00	.79	1.8
Lights and power	6	.57	.23	.5
Cow testing	2	.24	.10	.2
Taxes	8	.80	.31	.7
Inspection	3	.29	.11	.3
Insurance	2	.14	.06	.2
Veterinary service	2	.17	.06	.2
All other†	4	.34	.14	.4
Total	1200	117.98	46.70	110.1
Credits other than for butterfat‡	110	10.82	4.28	10.1
Cost of butterfat	1090	107.16	42.42	100.0

*Calculated at the rate of $2.85 per month of full feed.
†Includes, ice, fly spray, medicines, strainer disks, etc.
‡Includes credits for skim-milk, calves and manure.

For this period, the gross cost of producing butterfat was $118 per cow and 46.7 cents per pound. During the 3 years, the gross cost per cow declined only $2.38, while the cost per pound declined 4.99 cents. The decline in cost per pound was chiefly the result of an increased production per cow, and to a lesser extent to lower prices for feed in 1938 and 1939, particularly in 1938. The average feed cost was $51.58 per cow and 20.42 cents per pound of butterfat. Feed costs per pound of butterfat dropped from 22.3 cents in 1937 to 18.99 cents in 1939. Labor costs amounted to $40.61 per cow, or 16.07 cents per pound butterfat.

Hauling milk cost 3.15 cents per pound butterfat and interest on investment 2.1 cents.

Inasmuch as the gross costs of $118 per cow and 46.7 cents per pound butterfat produced something more than butterfat, an adjustment should be made for the other credits. These credits averaged $10.78 per cow, or 4.28 cents per pound butterfat. These subtracted from the gross costs leaves an average net cost for butterfat of $107.22 per cow, or 42.42 cents per pound. The variation in cost for the three years was from 44.65 cents per pound butterfat in 1937, to 40.14 cents in 1939.

The average cost of producing a pound of butterfat was greater by 3.5 cents than the price for which the butterfat sold. The cost exceeded the selling price in every year. In 1937, the difference was only about a quarter of a cent, while in 1938, it was 5.76 cents. The fact that the cost exceeded the selling price does not necessarily mean that the farmers lost money on their milking enterprise. It means only that they did not earn 25 cents per hour for their labor, or that they did not receive current market prices for their feeds, or did not earn 5 percent on the capital invested.

The net cost of producing a pound of butterfat varied considerably among the farms each year. For the three years, 16 of the records had costs of less than 30 cents per pound, while another 16 had costs of more than 65 cents per pound (table 9). The cost on most farms ranged from 30 to 50 cents per pound, with a slight tendency to center about 40 cents. As profits are

Table 9. *Variation in cost of producing a pound of butterfat, 1937, 1938 and 1939*

Total costs of producing butterfat per pound	Number of records				Percent of total 1937-39
	1937	1938	1939	1937-39	
Less than $.30	2	8	6	16	3.5
.30 to .33	10	21	23	54	11.9
.34 to .37	20	24	22	66	14.6
.38 to .41	25	31	23	79	17.5
.42 to .45	24	20	27	71	15.7
.46 to .49	26	24	9	59	13.1
.50 to .53	12	13	11	36	8.0
.54 to .57	10	7	6	23	5.1
.58 to .61	8	6	6	20	4.4
.62 to .65	5	3	4	12	2.7
.66 to .69	2	3	0	5	1.1
.70 or more	7	3	1	11	2.4
Total	151	163	138	452	100.0

closely associated with costs of production, the great variation in costs indicates that there must also have been great variation in profits.

FINANCIAL SUCCESS OF THE MILKING ENTERPRISE

A method frequently used to measure the success of an enterprise is to calculate the actual earnings of labor, or the amount remaining after all other factors of production have been paid at current market prices. On farms in this study, the total expenses exceeded the receipts in all 3 years when labor was included as an expense at 25 cents per hour. This is shown in table 10 as a minus net

Table 10. *Financial summary for milking herd 1937-1939*

Item	Average amount per farm			
	1937	1938	1939	1937-39
	dollars			
Total receipts and credits	1,182	1,021	1,070	1,091
Total expenses	1,212	1,191	1,196	1,200
Net profit or loss	–30	–170	–126	–109
Man labor at 25c per hour*	422	407	409	413
Return for labor	392	237	283	304
Return per hour of labor (cents)	23.3	14.6	17.3	18.1
Return for labor per cow	$38.43	$23.46	$27.75	$29.71

*Included in total expense above.

profit. However, when the value of labor, previously deducted as an expense, is added to the net profit, a positive return is shown for labor each year. The total returns to labor per farm ranged from $237 in 1938 to $392 in 1937, or an average of $304. This amounted to 18.1 cents for each hour of labor spent on the milking enterprise and $29.71 for the labor spent on each cow. The returns per hour of labor in 1937 were 23.3 cents and in 1938 only 14.6 cents. Although labor did not earn 25 cents per hour on the milking enterprise, most of what was earned was a net gain to the farmer and his family, as little or no alternative use that would have produced an income existed for the labor.

LABOR REQUIREMENTS OF THE MILKING ENTERPRISE

During 1937 and 1938, the average farmer spent 1,652 hours working directly on the milking enterprise (table 11). Of the total, about 65 percent was required for milking and caring for the milk and equipment. The total hours include only the time spent direct-

Table 11. *Labor requirements of milking enterprise 1937-38**

Labor operation	Hours per farm			Hours per cow		
	1937	1938	1937-38	1937	1938	1937-38
Feeding cows and cleaning stables	427	416	422	42	41	42
Milking and caring for milk and equipment	1,077	1,054	1,065	106	104	105
Driving and herding cows	143	123	133	14	12	13
Hauling feed†	34	30	32	3	3	3
Total	1,681	1,623	1,652	165	160	163

*Data are not included for 1939 because the data were not comparable. In changing to the account book, the schedule for obtaining these data was changed so that several operations were joined together which resulted in lack of comparability with the earlier years.

†Includes time for hauling pulp, pea silage and similar feeds. It does not include hauling hay. Hauling hay was included only in cases where it was the usual practice to haul it from barn to the feed lot for the cows, in which case it was considered as feeding.

ly upon the milking enterprise and do not include any time caring for calves, heifers or bulls, nor for fencing or repairing buildings.

The hours of man labor required to care for a cow varied considerably from farm to farm. In 1938, on 17 percent of the farms, less than 120 hours of labor were required, while on 15 percent of the farms, 220 or more hours were required. Other studies of labor requirements on milking cows in Utah show the same general result.[4] An average of 160 hours per cow has been used for some time in the work of the Department of Agricultural Economics of the Utah Agricultural Experiment Station.

FEED FOR THE MILKING HERD

Although farm pasture is usually considered as a prerequisite to the keeping of dairy cows, during the period 1937 to 1939, the average cow received about twice as much feed from hand feeding of harvested feeds as from pasture (table 12). The average was 216 days of sustenance from hand feeding, 109 from pasture and 40 from grazing in farm fields. Actually most cows were on farm pasture considerably longer than this, about 150 days, but during the late summer when the pastures were dry and feed was scarce, there was considerable supplementary feeding.

The number of days of feed from pasture was about the same

[4]Unpublished data, Department of Agricultural Economics, Utah Agricultural Experiment Station.

Table 12. *Source of feed for milking herd, 1937, 1938, 1939*

Source	Days of full feed per cow				Percent of total
	1937	1938	1939	1937-39	1937-39
Hand feeding	210	220	216	216	59
Grazing farm pastures	109	109	110	109	30
Grazing farm fields	46	36	39	40	11
Total	365	365	365	365	100

in each area. In the high valleys, the pasture season was somewhat shorter, but less supplementary feeding was necessary during the season because of better pastures.

It cost an average of $5.20 per month to feed a cow with harvested feeds, while grazing was calculated at only $2.85 per month of full sustenance (table 13). This indicates a considerable advantage to the dairymen who had enough pasture to carry cows through the summer without supplementary feeding. However, this advantage was largely offset by differences in rates of butterfat production which may or may not have been the result of the differences in feed. By far the major acreage of pasture is dry grazing land, on which a fair to good growth of reasonably palatable feed is generally available for the first month or two of the grazing season. After that the pastures become so dry that practically no new growth of grasses is made and the existing forage likewise becomes dry and unpalatable. The feed for the last half of the season, even where the acreage of pasture is large in rela-

Table 13. *Costs per cow month of feed from different sources, 1937-1939*

Source	1937-39
	dollars
Hand feeding	5.20
Grazing farm pastures*	2.85
Grazing farm fields*	2.85
Average of year	4.24

*Calculated uniformly at this amount which was arrived at from the records of those who paid a specified fee per cow per month for pasture. The amounts paid were adjusted as accurately as possible for the amount of supplementary feeding done. Because of the joint usage of most pastures by various classes of stock and also the joint costs, it was not deemed feasible to attempt to obtain the actual cost of pasture on each farm. Although pastures differ greatly in quality, and a month's grazing should be valued differently for pastures of different quality, a month of full feed from pasture should be worth approximately the same, regardless of the quality of the pasture in terms of the amount of feed available.

tion to the livestock, consists largely of greasewood and the dry unpalatable grasses remaining from the spring growth. Even if abundant in quantity, this does not make good feed for milk cows. Consequently, nearly all farms do some supplementary feeding during the latter half of the summer and some supplement the feed obtained from grazing all of the time. The above described situation is particularly characteristic of the lower areas. The high valley areas have many pastures that are naturally moist enough to provide a good growth of grass throughout the summer. Irrigated pastures were used on a few farms, but in total the practice was not important.

A large variety of feed was fed to the milk cows, but by far the most important was alfalfa hay (table 14). Wet beet pulp was probably next in importance. Farm grains, barley, oats and wheat, of which barley was the most important, were the third

Table 14. *Amount of feed fed the milking herd per farm, and average prices, 1937, 1938, 1939*

Feed	Unit	Amount fed per farm			Prices used		
		1937	1938	1939	1937	1938	1939
						dollars	
Alfalfa hay	tons	36.2	36.2	31.8	8.25	7.50	8.25
Other hay	tons	1.4	.9	.9	5.50	4.50	5.50
Corn silage	tons	1.0	1.2	.3	3.30	2.50	3.00
Pea silage	tons	4.7	3.2	3.1	2.40	2.00	2.40
Beet pulp (wet) *	tons	15.6	17.8	18.7	1.00	1.00	1.00
Beet molasses†	cwt.	5.4	6.0	4.2	.60	.60	.60
Barley	bu.	30.6	62.8	85	.73	.50	.45
Oats	bu.	16.5	26.5	36	.49	.37	.37
Wheat	bu.	8.1	7.7	12	1.00	.65	.60
Prepared dairy feed†	cwt.	6.3	5.1	4	2.26	1.59	1.25
Wheat bran†	cwt.	2.0	1.6	1.9	1.02	.75	.90
Dried beet pulp†	cwt.	.....	.3	2.0	.....	1.11	1.11
Beet tops‡	tons	.....	.2	1.0	.....	.50	.50
Corn fodder	tons	1.1	1.1	1.0	2.00	1.85	1.75
Carrots	tons	.4	.2	.3	4.00	4.00	4.00
Corn (grain)	bu.	.3	.7	.....	1.00	.60	.....

*Although beet pulp was purchased by all who fed it, the actual cash cost differed so that a uniform charge of $1.00 per ton was made. This was arrived at by assuming an average of 50 cents per ton paid to the sugar companies and assuming a value of 50 cents per ton for the right of the beet grower to purchase pulp. Many feeders paid this amount to other beet growers for their beet pulp rights.

†As these feeds were all purchased, the actual purchase price was used. The prices given here represent the averages of the prices paid.

‡Includes only those beet tops that were hauled to the cows. Those tops obtained by the cows directly by grazing the harvested fields, are included in the feed obtained from grazing farm fields.

most important feeds. Considerably more grain was fed in 1939 than in 1937. The average herd was fed 31.6 bushels of barley in 1937, 62.8 bushels in 1938 and 85 bushels in 1939. All other feeds were relatively unimportant on the farms as a whole, though some may have been important on individual farms.

In calculating feed costs, the same prices were used on all farms for the home grown feeds. The price used represents as nearly as could be ascertained, the average farm price throughout the year. As practically all farm grains were rolled or ground before feeding, the prices shown in table 14 includes the cost of processing. For those farms that fed the grain whole, the price used was the farm price of the grain only. The prices used for those feeds that are not commonly bought and sold and hence have no established market price, such as corn silage, corn fodder and carrots, were arrived at on the basis of their feeding value in relation to the feeding value and price of alfalfa hay.

On the basis of total digestible nutrients and net energy value as given by Henry and Morrison,[5] all of the feed was calculated in terms of one common feed unit. The unit used was a ton of alfalfa hay. The result is referred to as tons of hay equivalent.[6] The factors used in converting the various feeds are given in the appendix table 1.

Each year the average farmer fed about 45 tons of alfalfa hay equivalent, or 4.4 tons per cow (table 15). The average cost was $378 per farm, or $37 per cow, or $8.43 per ton. This varied somewhat between years as the price of feed varied, being highest in 1937 and lowest in 1938. However, the greatest difference amounted to only $3 per cow. The average cost per ton of alfalfa equivalent was slightly higher; 56 cents, 44 cents and 30 cents for 1937, 1938, and 1939, respectively, than the price of alfalfa hay. The reason for the higher price was that a ton of alfalfa hay equivalent in the form of grain or other concentrated feed, cost considerably more than a ton of hay. A ton of alfalfa hay equivalent in the form of barley, with barley at 50 cents a bushel, would cost $13.55 as it requires approximately 27 bushels of barley to

---

[5]Henry, W. A. and Morrison, Frank B. *Feeds and feeding.* 19th ed. Ithaca, N. Y., Henry-Morrison Co., 1928.

[6]For a few feeds adjustments were made, by judgment, for obvious discrepancies between farm feeding conditions and experimental conditions. Also for a few feeds such as certain prepared feeds, where feeding values were not given, the values were estimated by judgment in comparison with similar feeds with known values. The volume of feeds fed for which values were estimated and for which adjustments were made was so small that they could not appreciably affect the total.

Table 15. *Total tons of hay equivalent fed, its cost and the proportion that was in selected feeds, 1937,1938 and 1939*

Year	Total hay equivalent fed	Average cost hay equivalent fed		Percent of hay equivalent that was			
	Per cow	Per ton	Per cow	Alfalfa hay	Wet beet pulp	Barley oats and wheat	All other
	tons	*dollars*	*dollars*	*percent*	*percent*	*percent*	*percent*
1937	4.5	8.81	39	80	7	4	9
1938	4.6	7.94	37	77	8	8	7
1939	4.2	8.55	36	74	9	10	7
Average	4.4	8.43	37	77	8	7	8

equal a ton of alfalfa hay in feeding value. Oats at 49 cents a bushel would cost $22.43 a ton of alfalfa hay equivalent.

Of the total hay equivalent fed, 77 percent was alfalfa. This varied from 80 percent in 1937 to 74 percent in 1939. The decrease in the percentage in alfalfa hay was just made up by the increase in farm grains which increased from 4 percent in 1937 to 10 percent in 1939. The average of farm grains was 7 percent. Wet beet pulp made up an average of 8 percent and all other feeds totaled 8 percent. The more liberal feeding of grain is probably one of the reasons for the increased butterfat production per cow, and although it cost more than alfalfa hay per ton of hay equivalent up to an indefinite portion of the total feed, it may be just as cheap and under certain conditions cheaper, when measured in terms of productivity. This depends upon the relative prices of alfalfa, grains, and butterfat, and also upon the productive capacity of the cows to which it is fed.

FACTORS AFFECTING COSTS AND RETURNS OF MILKING ENTERPRISE[7]

THE analysis of factors affecting the efficiency and the financial success of the milking enterprise is somewhat more difficult than the analysis of the efficiency and success of the entire farm business. A measure of financial success for the enterprise comparable to "labor earnings" which is used for the entire farm busi-

[7]In this section, sorts and sub-sorts, using the combined records for the three years, have been used. However, these sorts were all made first for each year. Most of the items were so uniform that only the averages for the total records are included. The averages in this section, unlike those used in the description of the milking enterprise, are weighted averages. The total values for each of the three years were added and the sum divided by the total number of records involved.

ness would have little meaning in a comparison of farms, because of the variation in the size of the enterprises and also because of the greatly varying importance of the enterprise to the farm as a whole. Furthermore, the objective of a farmer is not to get the maximum income from any one enterprise, but to get the maximum returns from his entire business. There is no single measure of financial success for the milking enterprise that is entirely satisfactory.

MEASURES OF FINANCIAL SUCCESS

Although there is no entirely satisfactory single measure of success, there are several that are helpful in analyzing the operations of the milking enterprise. Three such measures that have been used in this report are listed below, together with a discussion of their advantages and disadvantages.

1. *Returns per hour of labor:* This is the measure that is probably used most often in analyzing enterprises. It has the advantage that it makes possible a comparison of the relative profitableness of all enterprises on the same farm and between farms. However, it restricts profitableness to narrow limits, namely, the returns for one hour of time. To a farmer with plenty of labor and only a small business, an enterprise that pays only 20 cents an hour, but provides twice as many hours of labor, may in the long run be more profitable than an enterprise that returns 30 cents an hour. Most farmers are probably more interested in some measure of returns from an enterprise that has a closer relation to the total profits than does the rate of returns for the hours worked.

Returns per hour of labor has the further disadvantage of being partly influenced by the number of hours worked on the enterprise. For such enterprises as the dairy, the hours worked are difficult to get accurately. The enterprise involves labor every day in the year, but the amount of labor per day varies, since the number of cows milked varies within the year, as do feeding practices.

2. *Returns for man labor per cow:* This measure is based on the average number of cows in the milking herd throughout the year.[8] This can be obtained relatively accurately. It also measures the degree of financial success in the form of a total that is much broader than an hour of labor. At the same time, it provides for comparability between farms, regardless of size and importance. It thus removes some of the disadvantages of returns per hour of labor as a measure. It has, however, two relatively important disadvantages. It can be used only to compare like enterprises on

[8]The average of 13 monthly inventories was used in this study.

different farms or the same enterprise on the same farm for different periods of time . Also, it attaches no importance whatever to the efficiency with which man labor is used on the enterprise. This is probably its greatest disadvantage.

3. *Total cost of producing a pound of butterfat:* This measure, as used in this report, includes all of the costs incurred on the farm, plus the cost of hauling from the farm to the receiving plant. While the farmer actually hauled his own milk in only a few cases, in practically all cases, he had to pay for it.

A disadvantage of this measure of financial success is that it includes as an important part of the total, the cost of family labor. As was pointed out in connection with returns per hour of labor, accurate record of the time spent on the cows is difficult to get. Also the rate at which the labor is charged can greatly influence the results. There is no definite way of determining what the rate should be. In this study labor was charged at 25 cents per hour. Inasmuch as this was not earned in any one of the three years by the average farmer it may have been too high. Also on many of the farms much of the labor spent on the cows during the winter and in other slack periods had no alternative value and consequently, some would argue, should not be considered an expense at all, but a net gain. But even if this reasoning is accepted in principle it is practically impossible to apply in a study of a group of farms.

Another important disadvantage of this measure is that it considers only one side of the factors that determine financial profits, that of costs. The selling price is also important. While the selling price of butterfat was much less variable than costs, it was not a fixed price and it therefore should be taken into account in a measure of success. It is probably the best measure of efficiency in production that has been devised and is better as a measure of production efficiency than as a measure of financial success. However, the financial success of an enterprise is closely associated with production efficiency.

VARIATION IN RETURNS FOR MAN LABOR PER COW

For the three years, the average returns for man labor per cow was $29 (table 16). This amounted to about 18.1 cents an hour. The average returns, however, were far from representative of every record. Not only did 56 herds, 12 percent of the total, return nothing for man labor, but they also failed to make market prices for all of the feed, capital, or other costs incurred. At the same time, 41 herds, or 9 percent, made $60 or more per cow for

Table 16. *Variation in returns for man labor per cow 1937, 1938 and 1939*

Returns for man labor per cow	Farms			Total 1937-39	Percent of total number
	1937	1938	1939		
dollars		*number*			*percent*
Less than –20	0	4	1	5	1.1
–20 to –11	5	6	3	14	3.1
–10 to –1	5	19	13	37	8.2
0 to 9	9	21	12	42	9.3
10 to 19	12	19	26	57	12.6
20 to 29	19	35	20	74	16.4
30 to 39	26	22	23	71	15.7
40 to 49	26	18	21	65	14.4
50 to 59	29	7	10	46	10.2
60 to 69	7	4	6	17	3.7
70 to 79	9	4	1	14	3.1
80 to 89	2	1	0	3	.7
90 to 99	2	1	2	5	1.1
100 or more	0	2	0	2	.4
Totals	151	163	138	452	100.0
Average returns	$38	$23	$28	$29	

labor. Most of the records showed returns between $10 and $50 per cow per year.

While all of the variations cannot be satisfactorily explained, the effect of the major factors can be shown. Also it may be as important to know what factors did not cause the variations as it is to know those that did cause them.

NUMBER OF COWS IN THE MILKING HERD

Returns for man labor per cow were highest, $35 per cow, on those farms which kept an average number of cows (table 17).

Table 17. *Relation of number of milking cows per farm to various factors 1937 to 1939*

Number of cows per farm:		Records	Butterfat produced per cow	Man labor per cow	Investment in buildings per cow	Total cost per pound butterfat	Returns for man labor per cow
Range	Average						
		number	*pounds*	*hours*	*dollars*	*dollars*	*dollars*
Less than 6	5.2	71	270	196	38	.455	25
6 to 8	7.4	160	257	181	35	.447	28
9 to 11	10.2	85	261	168	30	.426	35
12 to 14	13.4	62	248	156	35	.437	30
15 or more	18.3	74	243	142	40	.442	28
All farms	10.2	452	256	163	35	.442	29

The highest returns per hour of labor were also obtained by this group. The returns per cow, which amounted to $25, were lowest on the farms with the fewest cows.

The herds that were smallest in size had the highest production of butterfat per cow and the largest herds had the lowest. These relationships, however, were just reversed for the price received per pound of butterfat sold so that the gross value of butterfat per cow was just about the same for each of the two groups. The higher prices received on the farms with the larger herds indicates that the larger herds were producing for the market milk trade.

The most consistent relationship shown in this table is between the number of cows and the hours of man labor per cow. Herds of less than 6 cows required an average of 196 man hours per cow, while herds of 15 or more cows required an average of only 142 hours of man labor. This difference in labor required amounts to a difference of $13.50 in the total costs per cow. As the number of cows increased, the hours per cow decreased.

The number of cows in the milking herd was not an important factor in accounting for the variation in returns for man labor per cow. It did have an important effect upon the number of hours required to care for a cow and was associated with the highest prices received for butterfat sold. But the saving in labor and the higher prices received tended to be offset by lower production per cow. In two of the three years, the largest returns for man labor per cow, and also the lowest cost per pound of butterfat, were for the herds with from 9 to 12 cows. There is no certainty, however, that the specific number of cows kept was the causal or determining factor.

POUNDS OF BUTTERFAT PRODUCED PER COW

Regardless of which measure of profits is used, there was a high degree of association between pounds of butterfat produced per cow and profits (table 18). The variation in returns for man labor per cow was from $4 for herds which produced less than 210 pounds of butterfat to $48 for herds which produced 300 or more pounds. For the same production groups, the variation in returns per hour of labor was from 3.5 to 29.8 cents, while the cost per pound of butterfat ranged from 55.7 to 36.5 cents. Between herds that produced less than 210 pounds and those that produced more than 300 pounds per cow, more than 80 percent of the value of the increased production accrued to man labor.

The pounds of butterfat produced per cow had little relation

Table 18. *Relation of pounds of butterfat produced per cow to various factors, 1937-1939*

Pounds of butterfat per cow: Range	Pounds of butterfat per cow: Average	Records	Total cost per pound butterfat	Returns for man labor per cow	Returns per hour man labor
		number	*dollars*	*dollars*	*dollars*
Less than 210	181	89	.557	4	.035
210 to 239	225	88	.467	24	.148
240 to 269	255	90	.428	30	.186
270 to 299	283	88	.401	37	.227
300 or more	330	97	.365	48	.298
All farms	256	452	.442	29	.181

to the labor and feed costs per cow, but had a marked relation to the same costs per pound of butterfat (table 19). With an increase in butterfat production from less than 210 pounds per cow to more than 300 pounds per cow, the labor costs per cow increased from $38 to $44, but the labor cost per pound of butterfat decreased from 21.3 cents to 13.3 cents. For the same production groups, feed costs per cow increased from $51 and $56, but feed costs per pound of butterfat declined from 28.4 cents to 17.1 cents. The higher feed costs per cow for the high producing herds resulted from fewer days feed from pasture and heavier feeding,

Table 19. *Relation of pounds of butterfat produced per cow to feed and labor cost of butterfat, 1937-1939*

Pounds of butterfat per cow	Days feed from pasture	Tons of hay equivalent fed per cow: Total	Tons of hay equivalent fed per cow: Concentrates	Cost of feed per cow	Cost of feed per pound butterfat	Labor cost per cow	Labor cost per pound butterfat
	days	*tons*	*tons*	*dollars*	*dollars*	*dollars*	*dollars*
Less than 210	165	4.2	.4	51	.284	38	.213
210 to 239	153	4.3	.2	49	.192	43	.192
240 to 269	151	4.4	.4	51	.201	44	.173
270 to 299	147	4.6	.4	52	.184	45	.157
300 or more	133	5.1	.7	56	.171	44	.133
All farms	149	4.5	.4	52	.211	43	.173

particularly of concentrates. The amount of succulent feed fed was about the same for all groups.

One of the big reasons for the variation in returns for man labor per cow was the variation in the pounds of butterfat produced per cow. The important items of expense did not increase in proportion to the increase in production.

Occasional reference is made through the remainder of this report to factors that affect production per cow. A complete discussion of this subject is not within the province of this report. However, the most important factor is such that it is not measured by these data. It is the inherent capacity of cows to produce butterfat. This is partly a characteristic of breeding and partly an individual characteristic. There is an absolute production limit for each animal. With animals of little inherent capacity, it is reached much sooner than with animals of great inherent capacity. Notwithstanding the inherent capacity, the actual production may be influenced by feeding, housing and other management and environmental factors. Probably the profitable limit of production for any cow is somewhat less than the absolute limit. That is, the cost of obtaining the last possible pounds of butterfat from a cow exceeds the value of the butterfat. In fact, with normal price relationships for feed and butterfat some cows, because of their limited capacity, cannot be made to produce at a profit regardless of how they are fed. At the same time other cows and herds are underfed and under-cared for, for maximum profits.

This condition makes it economically desirable for the dairyman to adopt such practices as will provide him with a reliable measure of each cow's capacity to produce butterfat and then to feed each cow according to her capacity. With such information the feeding program can also, within limits, be adjusted in line with changes in the price of feeds and with changes in feed and butterfat price relationships.

HOURS OF MAN LABOR PER COW

The relationship between the average number of hours spent per cow and the financial success of the dairy enterprise depends upon what measure of financial success is used. Within low, average, and high levels of butterfat production the total cost of butterfat went up and the returns per hour of man labor went down as the hours spent on the cows increased (table 20).

The factor with which hours of man labor per cow was most consistently associated was the number of cows per farm. Less time is required to care for a cow in a large herd than in a small herd. In general, no significant increases in butterfat production resulted from spending more than the minimum amount of time in caring for the cows. The only other possible economic advantage would be to reduce costs such as to prevent waste of feeds. If any such advantage was obtained it was so small that it was obscured. No doubt much of the variation in hours of labor per cow resulted

Table 20. *Relation of hours of man labor per cow to various factors on farms with similar butterfat production per cow, 1937-1939*

Hours of man labor per cow		Records	Butterfat produced per cow	Cows per farm	Total cost per lb. of butterfat	Returns for man labor	
Range	Average					Per cow	Per hour
		number	*pounds*	*number*	*dollars*	*dollars*	*dollars*
	Lower third of farms in production per cow						
Lower third	112	49	187	13.0	.493	5	.049
Average third	148	49	200	10.8	.480	16	.106
Upper third	216	51	209	8.1	.584	10	.050
	Average third of farms in production per cow						
Lower third	124	51	257	11.4	.375	35	.277
Average third	172	50	257	9.8	.423	31	.180
Upper third	228	51	255	9.3	.484	28	.127
	Upper third of farms in production per cow						
Lower third	128	50	310	11.9	.347	47	.377
Average third	172	50	314	9.1	.372	48	.275
Upper third	232	51	318	8.2	.421	44	.191
All farms	163	452	256	10.2	.442	29	.181

from differences in the physical layout of farms and differences in the physical ability of laborers. However, some of it probably resulted from intentional management practices. To that extent the practices were in general economically unsound as those who spent the least time obtained total returns as large as those who spent the most time This means of course that the returns per hour of labor were higher.

AMOUNT OF FEED OBTAINED FROM GRAZING

The objective in feeding dairy cows is not to feed at the lowest possible cost, but to feed so that the maximum returns will be obtained from the feed, labor and other capital employed. It was pointed out earlier in this report that pasture was charged at the rate of $2.85 per month of sustenance, while the average cost of hand feeding was $5.20 per month.[9] However, on the farms being studied, no particular financial advantage from the milking enterprise accrued to those with relatively large amounts of grazing for milk cows (table 21). This was probably because of the poor quality of the pasture. Butterfat was produced at the lowest cost per pound ($.423), and the highest returns were obtained for man labor per cow ($34) and per hour ($.208) on the farms with the least grazing. The farms on which cows received the largest amount of feed from grazing were below average for all three

[9]Table 13, page 16.

Table 21. *Relation of days of full feed from grazing to various factors 1937-39*

Full feed from grazing		Records	Butterfat produced per cow	Feed costs per pound butterfat	Total costs per pound butterfat	Returns for man labor	
Range	Average					Per cow	Per hour
days	*days*	*number*	*pounds*	*dollars*	*dollars*	*dollars*	*dollars*
Less than 120	86	85	281	.200	.423	34	.208
120 to 139	131	69	253	.224	.465	24	.159
140 to 159	150	100	256	.205	.439	30	.181
160 to 179	170	99	252	.212	.443	30	.181
180 or more	196	99	242	.215	.445	27	.173
Total or average	149	452	256	.211	.442	29	.181

measures. The difference in the total cost of feed between these two groups was more than made up by the difference in the pounds of butterfat produced per cow. Whether the larger butterfat production resulted from differences in feeding, or from other factors cannot be told from the data. The least returns were made by the herds that obtained an average of 131 days of feed from grazing. The butterfat production per cow on those farms was below average and did not offset the higher feed costs.

AMOUNT OF FEED FROM GRAZING BY COWS PRODUCING EQUAL QUANTITIES OF BUTTERFAT

In order to eliminate the effect of the inter-relationship between amount of feed from grazing and butterfat production per cow, a sort was made showing the effect of amount of feed from grazing upon profits from the dairy herd for herds of the same level of production. This shows that for herds of approximately the same butterfat production per cow, the amount of feed obtained from grazing had but little relation to the feed costs, or total cost per pound of butterfat, or upon the returns for man labor (table 22). This means that whatever affect the differences in source of feed may have, it is so slight that it is largely obscured by the effect of other factors such as butterfat per cow, labor costs or probably some unmeasured item.

There was a tendency for the farms with low butterfat production per cow to use more pasture than those with high production. However, there was more variation within the groups of farms with the same level of production than there was between the groups with different levels of butterfat production. This indicates that grazing as a source of feed for dairy cows had only a

Table 22. *Relation of days of full feed from grazing to various factors for farms with similar butterfat production per cow*
Average 1937-39

Full feed from grazing		Butterfat produced per cow	Feed cost per pound butterfat	Total cost per pound butterfat	Labor costs per pound butterfat	Returns for man labor	
Range	Average					Per cow	Per hour
days	*days*	*pounds*	*dollars*	*dollars*	*dollars*	*dollars*	*dollars*
		Lower third of farms in production per cow					
Lower third	124	205	.260	.523	.199	10	.074
Average third	160	196	.256	.519	.196	11	.071
Upper third	194	195	.250	.504	.214	10	.066
		Average third of farms in production per cow					
Lower third	110	257	.212	.446	.171	27	.175
Average third	158	256	.194	.423	.182	35	.208
Upper third	188	256	.195	.413	.163	32	.203
		Upper third of farms in production per cow					
Lower third	85	320	.175	.378	.143	46	.282
Average third	147	311	.179	.385	.148	46	.278
Upper third	178	307	.171	.369	.136	44	.270
All farms	149	256	.211	.442	.173	29	.181

moderate effect upon butterfat production per cow, as within each production group the average pounds of butterfat per cow was not greatly different although the trend was consistent. Consequently, the variation in production per cow was probably only partially the result of the variation in the use of grazing as a source of feed.

The proportion of the total feed obtained by grazing had no ascertainable relation to the amount of labor required to care for the cows.

In interpreting these data showing the relation of days of feed from grazing to other factors the nature of the major part of the pasture used should be considered.[10]. Had first class pastures been generally available the results may have been different. However, had this been the case, the grazing probably would have cost more than $2.85 per month of full feed.

Regardless of the amount of feed from grazing, the farms with low butterfat production obtained returns of about $10 per cow for man labor while farms of average production obtained a little more than $30 per cow, and the high producing cows returned about $45 each for man labor. This emphasizes again the importance of rates of production upon the financial success of dairy farms.

[10]See section entitled "Feed for the milking herd," page 15.

AMOUNT OF HAY EQUIVALENT FED PER COW

As the amount of hay equivalent fed per cow increased, the days of feed from grazing decreased and the pounds of butterfat produced increased (table 23). The average amount of hay equiva-

Table 23. *Relation of tons of hay equivalent fed per cow to various factors 1937 to 1939*

Hay equivalent fed per cow		Records	Grazing per cow	Butterfat produced per cow	Feed cost per pound butterfat	Total costs per pound butterfat	Returns for man labor per cow
Range	Average						
tons	*tons*	*number*	*days*	*pounds*	*dollars*	*dollars*	*dollars*
Less than 3.25	2.80	55	178	235	.180	.414	33
3.25 to 3.99	3.64	102	166	251	.188	.413	33
4.00 to 4.74	4.37	121	147	252	.211	.436	31
4.75 to 5.49	5.08	92	143	265	.222	.451	20
5.50 or more	6.46	82	121	274	.247	.497	18
All farms	4.54	452	149	256	.211	.442	29

lent fed per cow ranged from less than 0.5 tons per month of full feed to nearly 0.8 tons. As the total amount of feed fed increased, the proportion that was concentrates increased also. The variation was from about 6 to 13 percent.

Returns for man labor were $33 per cow on farms where each cow was fed less than 3.25 tons of hay equivalent and $18 on farms which fed 5.5 tons or more per cow. Up to the feeding of a total of about 4.5 tons of hay equivalent, about 0.6 tons per month for the time fed, the returns for man labor per cow were not greatly different. Although more liberal feeding than this resulted in higher butterfat production per cow, it also resulted in high feed costs per pound of butterfat and was also associated with higher labor and other costs. The value of the additional product was not equal to the greater feed and other costs. The relationship between amount of feed fed and labor returns was not consistent each year.

AMOUNT OF CONCENTRATE FEED FED PER COW

Concentrate feed includes all grains and grain products, dairy mash, beet molasses and similar feeds. By far the major part of the concentrates consisted of grains, particularly barley, which were usually rolled or chopped before feeding. The basis for converting these feeds into alfalfa hay equivalent is given in appendix table 1.

Apparently the adding of concentrates to the dairy ration had

little affect upon the amount of the other feeds fed, for as the amount of concentrate fed per cow increased, the total amount of feed fed increased also (table 24). The pounds of butterfat pro-

Table 24. *Relation of amount of concentrate feed fed per cow to various factors, 1937-39*

Hay equivalent in concentrates fed per cow		Records	Hay equivalent fed per cow	Butterfat produced per cow	Feed cost per pound butterfat	Total cost per pound butterfat	Returns for man labor per cow
Range	Average						
tons	*tons*	*number*	*tons*	*pounds*	*dollars*	*dollars*	*dollars*
None	0.00	139	4.2	244	.207	.444	32
.1 to .3	0.15	106	4.2	247	.204	.425	30
.3 to .6	0.42	81	4.4	259	.202	.440	31
.6 to .9	0.74	47	4.9	269	.214	.443	28
.9 and more	1.34	79	5.5	280	.235	.463	22
All farms	0.42	452	4.5	256	.211	.442	29

duced per cow likewise increased. Probably the incease in butterfat resulted partly from more feed in total as well as from the larger quantities of grain. Up to the feeding of approximately one ton of hay equivalent in concentrate feeds, the equivalent of about 27 bushels of barley or 46 bushels of oats, there was nearly enough increase in butterfat to pay for the extra feed. The feeding of more than one ton tended to increase the costs per pound of butterfat and decreased the total returns. To cows with a capacity to produce butterfat greater than the average of the cows included in this study, the feeding of more than a ton of hay equivalent in concentrates may have been profitable. Also with price relationship such that a pound of butterfat would buy more grain than during 1937-39 the feeding of more grain may be profitable.

AMOUNT OF CONCENTRATES FED FOR DIFFERENT LEVELS OF BUTTERFAT PRODUCTION

In order to show the combined effect of variations in butterfat production per cow, and different amounts of concentrates fed on the returns for man labor, the records were sorted two ways, first into three groups on the basis of butterfat production, and then each of these groups was sorted into three sub-groups on the basis of the amount of concentrates fed. The results show that there is a great difference in the way different cows respond to grain feeding (table 25). On one group of farms, 47 in number, the cows received a total of 4.6 tons of hay equivalent of which .84 tons were concentrates and produced but 201 pounds of butterfat. An-

Table 25. *Relation of amount of concentrate feed fed and pounds butterfat produced per cow to various factors, 1937 to 1939*

Hay equivalent in concentrates fed per cow		Total hay equivalent fed per cow	Feed cost per pound butterfat	Pasture per cow	Total cost per pound butterfat produced	Butterfat produced per cow	Returns for man labor per cow
Range	Average						
tons		*tons*	*dollars*	*days*	*dollars*	*pounds*	*dollars*
	Lowest third of farms in production per cow						
Low third	.....	4.0	.241	168	.507	199	15
Middle third	.18	4.2	.247	158	.491	196	13
High third	.84	4.6	.281	149	.563	201	2
	Middle third of farms in production per cow						
Low third	.02	4.2	.192	161	.416	254	36
Middle third	.28	4.2	.190	154	.412	256	32
High third	.84	5.0	.223	136	.458	259	24
	Highest third of farms in production per cow						
Low third	.04	4.6	.163	148	.365	309	51
Middle third	.47	4.6	.167	140	.364	315	48
High third	1.38	5.7	.200	123	.412	321	37
All farms	.42	4.5	.211	149	.442	256	29

other group was fed the same amount of concentrates and produced 259 pounds of butterfat, while a third group produced 309 pounds of butterfat and received only .04 tons of concentrates. It seems clear that the variation in the capacity of cows to produce was much more important than was the amount of concentrates fed in accounting for the variation in production. However, it is probable that most cows that received liberal quantities of grain produced more milk than they otherwise would.

The profits were largest, $51 returns for man labor per cow, for the group of high producing cows that received a minimum of concentrate feeds, and lowest, $2 for the low producing herds that were fed the most grain. High producing cows that were fed considerable quantities of concentrates were more profitable than low producing cows that were fed no concentrates. Profits were more closely associated with production of butterfat than with the amount of expensive concentrate feeds that were fed. With price relations such as prevailed during 1937-39 the feeding per cow of one ton of hay equivalent in concentrates as compared to feeding no concentrates, was profitable only if by so doing the cows increased production by more than about 40 pounds of butterfat. Probably the cows that would have returned the largest profits from the feeding of grain were those that produced 300 pounds of fat or more with essentially no concentrate feed.

Apparently some other factor unmeasured, probably the inherent quality of the cows to produce butterfat, was more important than the amount of concentrate feed fed in determining the net returns for labor. As concentrates are usually more expensive feeds than forage or succulents, they can be profitably fed in quantities only to the higher producing cows under the price relationships that prevailed during the period of this study.

TYPE OF RATIONS FED

All of the feeds fed the milking cows were classified as either forage, concentrate, or succulent. The forage feeds were largely alfalfa hay but did include small amounts of other types of roughage. Concentrates include all grains and grain products, dairy mash, beet molasses and similar feeds. By far the major part consisted of grains. Wet beet pulp made up most of the succulent feeds, though some pea and corn silage and roots were included. Aside from the feed obtained by grazing, some herds were fed nothing but forage, some were fed forage and concentrates, others forage and succulents and some were fed a combination of all three. Among those farms that fed succulent and concentrate feeds, there was considerable variation in the quantity fed.

Those farms which fed forage only, fed more forage per cow, 3.9 tons of hay equivalent, but less total hay equivalent than those using other types of rations (table 26). The addition of succulent feeds tended to reduce the amount of forage fed, but the addition of concentrates changed the quantity of forage used very little. Consequently farms which fed the most concentrates, and those which fed the most concentrates and succulents fed a total of 5.07 and 5.81 tons of hay equivalent per cow, the largest for any type of rations. However, the herds which obtained heavy feedings of concentrates obtained less feed from grazing.

Herds that were fed forage only, or forage and succulents produced about the same amount of butterfat per cow, just a little less than 250 pounds. Herds that received in addition small quantities of concentrates produced an average of 259 pounds and with heavy feeding of concentrates, 275 pounds of butterfat per cow. Thus it seems that the addition of succulents to the ration replaced some forage but had little effect upon butterfat production, whereas the addition of concentrates did not change the amount of forage fed much, but increased the butterfat production.

The feed cost and the total cost per pound of butterfat was highest on those farms that included heavy feeding of concentrates in the ration (table 27). The feed cost in each case was more

Table 26. *Relation of type of ration to total feed and pounds of butterfat produced per cow, 1937-1939*

Type of ration	Records	Hay equivalent fed per cow per year			Total	Feed from pasture	Butterfat produced per cow
		Forage	Concentrates	Succulents			
	number		*tons*			*days*	*pounds*
Forage only	70	3.9	*	*	4.0	153	247
Forage and concentrates:							
Least concentrates	55	3.7	0.5	*	4.2	143	259
Most concentrates	51	3.9	1.1	*	5.1	119	275
Forage and succulents:							
Least succulents	84	3.7	*	0.4	4.2	161	244
Most succulents	81	3.3	*	1.1	4.5	164	250
Forage, concentrates and succulents:							
Least concentrates and succulents	56	3.2	0.5	0.5	4.2	152	259
Most concentrates and succulents	55	3.5	1.2	1.1	5.8	139	274
All farms	452	3.6	0.4	0.5	4.5	149	256

*Less than 0.1 tons per cow fed on any farm.

Table 27. *Relation of type of ration to costs and returns from butterfat production, 1937 to 1939*

Type of ration	Cost per pound of butterfat			Farm price received per lb. b.f. sold	Returns for man labor	
	Feed	Labor	Total		Per cow	Per hour
	dollars			*dollars*	*dollars*	
Forage only	.197	.179	.429	.343	32	.191
Forage and concentrates:						
Least concentrates	.201	.174	.436	.333	32	.197
Most conncentrates	.231	.171	.473	.350	29	.171
Forage and succulents:						
Least succulents	.209	.168	.425	.336	31	.214
Most succulents	.207	.190	.451	.337	30	.172
Forage, concentrates and succulents:						
Least concentrates and succulents	.206	.166	.438	.330	29	.188
Most concentrates and succulents	.234	.153	.457	.324	18	.118
All farms	.211	.173	.442	.336	29	.181

than 23 cents and the total cost was about 47 cents per pound of butterfat when concentrates were fed in conjunction with forage only and about 46 cents when forage, concentrates and succulent feeds were fed. Although the labor cost per pound of butterfat varied from 15 to 19 cents, it did not seem to be related to the type of ration fed.

The lowest returns per cow, $18, and per hour of labor, 11.8 cents, were for rations of forage and large amounts of concentrates and succulents. This may have resulted in part from the total amount of feed fed as much as from the ration, but it also suggests that some cows of low capacity were being fed more grain than they could utilize economically.

While these data are far from conclusive as to the most desirable ration for milk cows, they indicate that from an economic point of view discretion should be used in feeding the expensive concentrate feeds. These feeds were fed with profit only to the higher producing cows. While these data apply only to the conditions of 1937-39, the general principle that the higher producing cows will use expensive feeds most profitably always applies. The difference from one time to another is in the quantity that it is profitable to feed. The inherent quality of the cows, the relative price of various types of feeds and the price of butterfat are the most important factors determining whether or not it is profitable to feed concentrates.

PROPORTION OF BUTTERFAT SOLD JULY TO NOVEMBER

Beginning about July 1st, the feed in pastures in most of the area covered by this study becomes either inadequate in quantity, or of poor quality, or both. As a result the flow of milk normally is greatly reduced. To maintain a constant flow of milk, considerable supplementary feeding is required, as well as to have the freshening of cows equally distributed through the year. Many farmers prefer not to attempt to maintain a uniform flow of milk, but to have most of their cows freshen in the fall and be dry during the late summer. This is for two reasons: (1) They say it is much more difficult to keep cows in production during the late summer because of poor feed in pastures, heat, flies, and other environmental conditions, which supplementary feeding does not entirely overcome. (2) Having cows freshen in the fall and dry during the late summer helps to even out the labor requirements on the farm. During the winter months plenty of time is available to care for cows but during the harvest season, it is an advantage if most of them are dry.

If a uniform flow of milk were maintained, approximately 42 percent of the year's production would be produced from July 1st to November 30th. The average sales for all farms during 1937 to 1939 were 37.5 percent (table 28). On about 58 percent of the farms the sales of butterfat July to November amounted to less than 40 percent of the total. Probably less than a third of the farms sold as much as 42 percent during this period.

Table 28. *Relation of proportion of butterfat sold July to November to various factors, 1937 to 1939*

Butterfat sold July to November		Records	Butterfat produced	Total cost of butterfat	Farm prices per pound butterfat	Man-work-units per man (entire farm)	Returns for man labor per cow
Range	Average						
percent		*number*	*pounds*	*dollars*	*dollars*		*dollars*
Less than 30	25	78	249	.453	.315	286	23
30 to 34	32	69	257	.428	.327	288	28
35 to 39	37	115	260	.431	.348	277	33
40 to 44	42	120	258	.442	.340	251	30
45 and more	49	70	255	.462	.344	266	29
All farms	37.5	452	256	.442	.336	272	29

The largest returns for man labor per cow, $33, were obtained on farms that sold from 35 to 39 percent of the total during July to November, while the lowest returns for man labor, $25 per cow, were on farms which averaged only 25 percent for July to November. However, the relationship was not consistent. Labor earnings for the entire farm were highest, $1,013, on the farms with the lowest percent of sales from July to November and lowest, $807, on farms which sold more than 40 percent during this period.

The proportion of butterfat sold July to November had little, if any, effect upon the pounds produced per cow. However, the cost of butterfat tended to go up as the percentage sold July to November increased. But this relationship was not uniform. The higher costs were offset by higher farm prices. This is no doubt because a much larger proportion of the product was sold as market milk. It is obvious that farmers producing for the market milk trade must maintain a relatively uniform flow of milk through the year, or at any rate maintain production up to at least a specified amount at all times.

In order to determine whether or not the seasonal distribution of butterfat sales affected the profits of farms producing market milk and processing milk differently, separate sorts similar to those

in table 27 were made for the farms selling on each type of market. While there was some seasonal variation in the price of milk, particularly process milk, it was not particularly helpful to producers of large quantities during the period being considered. The lowest prices each year were reached before July and the highest prices after November. For the three year period the average price for both markets during July to November was essentially the same as for the entire year. So the advantages in having a uniform production would have to be in higher production per cow or in lower costs of production, rather than in receipt of a higher average price for the butterfat sold.

The farms selling market milk sold an average of 40 percent of their total sales during the period July to November. This was only about 2 percent less than would have been sold under uniform distribution through the year. In comparison, on the farms which sold processing milk only 36 percent of the sales was made during this period. The analysis of the farms selling on the different types of market showed no other significant differences from the analysis of all farms so far as the economics of the seasonality of production is concerned.

These data are not definitely conclusive in regard to whether or not it was economically desirable to maintain the milk flow during the late summer up to the level of the yearly average. To the extent that any conclusions can be drawn, it seems that the advantages were on the side of producing somewhat less than average rather than more during the late summer.

KIND OF MARKET FOR BUTTERFAT

Returns per hour of man labor were $0.27, $0.12 and $0.16 for farms that sold primarily market milk, process milk and other, respectively (table 29). Returns for man labor per cow amounted to $43, $21 and $26, respectively, for the same types of market. The factor responsible for most of the difference was the difference in the price received per pound of butterfat, which amounted to approximately 7 cents. However, the butterfat production per cow was also highest, 27 pounds per cow, on the farms producing market milk. It was only 245 pound per cow on the farms which produced milk for processing purposes as compared to 274 pounds on the farms which sold market milk. In part at least, the lower production per cow resulted in the highest cost per pound butterfat. However, labor costs per cow were also lowest on the market milk farms, $42 as compared to $43 and $46, respectively, on the farms selling process milk, and those selling cream or a combina-

Table 29. *Relation of kind of market for butterfat to various factors 1937 to 1939*

Kind of market	Records	Cows per farm	Butterfat produced per cow	Total cost of butterfat per pound	Farm price of butterfat sold per pound	Percent of b.f. sold July to November	Returns for man labor per hour
	number	*number*	*pounds*	*dollars*	*dollars*	*percent*	*dollars*
Market milk	168	12.0	274	.425	.380	40.2	.27
Process milk	255	9.0	245	.454	.311	35.5	.12
Other*	29	10.0	256	.438	.309	38.7	.16
All farms	452	10.2	256	.442	.336	37.5	.18

*Includes farms that sold largely cream, and those that sold an important part of their produce on more than one type of market.

tion of products. The larger number of cows on the market milk farms probably accounted for this.

Economically it was a great advantage to sell market milk over either process milk or cream. The type of market for dairy products then was another important factor affecting the variation in returns for labor from the milking enterprise.

SUMMARY AND CONCLUSIONS

DESCRIPTION OF THE MILKING ENTERPRISE

A TOTAL of 452 records was used in the study of the milking enterprise. The average number of cows per farm was 10.2. The average investment in the milking enterprise was $1,079 per farm, or $106 per cow, of which 58 percent was in cows and 34 percent in buildings.

The average pounds of butterfat produced per cow were 256. They increased from 242 in 1937, to 253 in 1938 and to 263 in 1939. Considerable variation existed between herds in the production per cow, as 11 herds produced less than 160 pounds and 13 herds produced more than 360 pounds.

While all the milk was sold on a butterfat basis, 42 percent was for use as market, or fluid, milk and 39 percent for manufacturing purposes—chiefly butter. However, more producers sold on the processing market than on the fluid milk market.

The average price at the plants was 42.6 cents per pound butterfat for market milk and 35.7 cents for butterfat for processing. The three year average for all butterfat sold was 39.1 cents and varied from 44.4 cents in 1937 to 36.2 cents in 1939.

Total receipts and credits per farm from the milking herd amounted to $1,091, of which $852 was for butterfat sold. Total expenses were $1,200 per herd, of which 44 percent was for feed and 34 percent for man labor at 25 cents per hour.

The average cost of producing a pound of butterfat was 42.2 cents. This includes the cost of hauling to the plant. The range in cost per pound between farms was wide, as 16 farms had costs of less than 30 cents per pound and 11 had costs in excess of 70 cents.

Returns for man labor from the milking enterprise were $392, $237, $283 and $304 per farm for 1937, 1938 ,1939, and the 3-year average, respectively. Similar returns per cow were $38, $23, $28 and $30; and per hour of labor 23.3 cents, 14.6 cents, 17.3 cents, and 18.4 cents for 1937, 1938, 1939 and the 3-year average, respectively.

In 1937 the average number of hours spent on each cow was 165 and in 1938, 160 hours. Comparable data were not obtained for 1939.

The cows were hand fed for an average of 216 days, and obtained 109 days equivalent of feed from pastures and 40 days from grazing farm fields.

The average cost of feed per cow month was $5.20 for hand feeding, and $2.85 for grazing.

Most of the feed fed the dairy cows, 77 percent, was alfalfa hay. About 8 percent was wet beet pulp and 7 percent farm grains. The amount of grain fed per cow more than doubled during the period of the study.

All feeds fed amounted to an average of 4.4 tons of hay equivalent per cow. The average cost was $8.34 per ton, which was slightly more than the price of alfalfa hay.

FACTORS AFFECTING COSTS AND RETURNS

A completely satisfactory measure of the profitableness of a single enterprise on farms with several important enterprises has not yet been devised. The fact that the dairy enterprise did not return as much as was charged for labor does not justify the conclusion that it was not profitable. Feed and labor were the major expenses and were largely provided by the farmer and his family, and, while an expense to the dairy, was part of the farm and family income. Also, some of the feed and much of the labor while charged at market prices had little or no alternative value. On most of the farms studied, the dairy enterprise was an important source of farm income.

The number of cows in the milking herd was not important in relation to the financial success of the enterprise as measured by either the cost of producing butterfat or the returns for man labor per cow. Probably the number of cows was more important in relation to the success of the farm as a whole. The factor most closely associated with the number of cows was the hours of labor required to care for each cow. As the number of cows increased, hours per cow decreased.

Labor returns per cow increased consistently and markedly as the pounds of butterfat increased. Production per cow was undoubtedly the most important single factor in determining the success of the dairy enterprise. The first step in obtaining high production is to have cows of great inherent capacity for production.

The number of hours of man labor spent in caring for the cows had but little relation to the amount of butterfat the cows produced. As the hours per cow increased the total cost per pound of butterfat increased and the returns per hour of man labor declined. Apparently even those operators who spent the least time in caring for their cows spent enough time that all essential work was done.

Feed for the milking herd is of major importance as it makes up nearly half of the total costs and also because of its influence on butterfat production. The economic analysis of the feeding of the herds included in this study shows:

1. The proportion of the total feed obtained by grazing had little or no ascertainable relation to the financial success of the enterprise. However, most of the pastures used by the cows included in the study were generally of poor quality, particularly during the late summer. Also even the herds that grazed most were hand fed approximately half of the time.
2. As the total amount of harvested feeds fed per cow increased the production per cow also increased, but the profits decreased. The additional production was not enough to meet the additional costs.

   As the total amount of feed fed increased the amount of concentrates fed also increased. The concentrates were more expensive than other types of feed. Also in feeding larger quantities of feed there may have been greater physical waste so that the cows didn't actually consume all the feed that was made available to them.
3. The adding of concentrate feeds to the ration had but little

affect upon the amount of other feeds fed. The total increased almost by the amount of the concentrate added.

4. Butterfat production per cow increased as the amount of concentrates fed increased. Nevertheless, within each of the groups of low, average, and high levels of production per cow the herds that were fed the most concentrate feed were the least profitable. However, the high producing herds that received liberal feedings of concentrates were more profitable than the low producing herds that received no concentrates. Thus the feeding of concentrate feeds was profitable if it resulted in a sufficiently large increase in production. Under the price relationships of 1937-39, the adding of one ton of hay equivalent in concentrates to a cow's ration was profitable only if production was increased more than approximately 40 pounds of butterfat.

Cows vary in inherent capacity to produce butterfat. This undoubtedly is the major reason for the variation in production per cow. Among the cows in each herd considerable variation usually exists in production capacity. This analysis was based on herd averages so undoubtedly within the low producing and low profit herds there were some cows that would more than pay for better than average care and feed. However, the profits from them were more than offset by the losses from the other cows.

The feeding of more than average quantities, or better than average quality of feed is profitable only if the cows increase production sufficiently to more than pay the extra costs. Obviously then whether or not it pays to feed more than a given quantity of feed, or any one particular feed, will depend not only upon how much production is increased, but also upon the cost of the various feeds and also the price at which the butterfat will sell. Prices are continually changing. In general the greater the amount of any particular feed, or of all feeds that can be purchased with the proceeds from a given quantity of butterfat, the greater the amount of feed that can be fed profitably.

The fact that the analysis shows that on the average the herds that received the least concentrates for a given level of butterfat production were the most profitable should not be interpreted to mean that the feeding of concentrates was not profitable. It only shows that a herd that will produce a given amount of butterfat, an average of 300 pounds for example, on forage alone is more profitable than a herd

that must receive concentrates to produce that amount. The most profitable herds were those that had high production, 309 pounds average, and were fed only forage. However, these were the herds that probably would have increased production most from the feeding of a given quantity of concentrates, and hence could most profitably have been fed liberal quantities of concentrates. Some herds received considerable quantities of concentrates and produced only about 200 pounds of fat. These were the least profitable of all and probably the feeding of concentrates made them less profitable than they otherwise would have been.

5. The main effect of adding succulent feeds to forage in the ration was the replacement of one feed by another, as the average production, costs, and returns were about the same for the herds that were fed forage only and those that were fed forage and succulent feeds.

The entire analysis of feeding practices indicates a management practice that would probably pay every dairyman to follow. That is to find the productivity of each cow in the herd and then cull out those that do not meet the minimum requirements for profits, and feed each of those that are kept according to her production.

No consistent relationship was ascertained between the proportion of total milk sold July to November and butterfat production per cow or any measure of financial success, for either market or process milk.

Returns for man labor averaged considerably higher for herds which produced for the fluid market than for herds which produced milk for processing. Although the price paid for market milk was considerably higher the production cost per pound of butterfat was lower than for process milk. The difference in costs was largely a result of differences in the pounds of butterfat produced per cow.

The most desirable organization and management for dairy herds apparently would involve a large number of high producing cows; the efficient use of man labor; sparing use of concentrate feeds for all except the cows of greatest capacity; and the sale of milk for fluid purposes. Of these, high production per cow and a fluid milk market were most important. Whether the cows obtained their feed from grazing, forage or succulent feeds, or whether a high level of milk flow was obtained during the summer and fall apparently made little difference to the financial returns.

APPENDIX

Table 1. *Factors for converting various livestock feeds to alfalfa hay equivalent**

Kind of feed	Amount necessary to equal 1 ton of alfalfa hay	Kind of feed	Amount necessary to equal 1 ton of alfalfa hay
Alfalfa	1.0 ton	Potatoes	3.0 tons
Timothy	1.5 tons	Beet molasses	0.75 ton
Wild hay†	1.5 tons	Wheat	21.1 bu.
Small grains hay	2.0 tons	Corn	22.6 bu.
Small grains straw	4.0 tons	Barley	27.1 bu.
Corn fodder (dry)	4.0 tons	Oats	45.8 bu.
Corn silage	2.5 tons	Rye	22.8 bu.
Beet tops	7.0 tons	Wheat bran	.75 ton
Pea vine silage†	3.5 tons	Cottonseed cake	.33 ton
Wet beet pulp	5.0 tons	Stock pellets†	.33 ton
Dried beet pulp	0.6 ton	Prepared dairy feed (average)	.60 ton
Sugar beets	2.5 tons	Poultry mash (average)†	.45 ton
Carrots	3.0 tons		

*Based primarily on "total digestible nutrients" and "net energy values" of various feeds, as reported in *Feeds and feeding,* by Henry and Morrison. 19th ed. Some adjustments were made for differences between farm feeding and experimental conditions. These were based on judgment only.

†Estimated and based on comparison with similar feeds.

College series no. 663